Question 6: Statement of Research Project

Project Summary

As the first operational HF radar deployment in the Great Lakes, the goals of this funded activity include:

1. Evaluation of the site-specific requirements in the Straits
2. Recommendation on optimum CODAR locations within the high interest regions of the Straits
3. A mapping of the transmit antennae patters and an evaluation of the influence of the bridge on signal strength.
4. Preliminary "right of way' discussions on station locations, set up costs and long-term O&M.
5. Acquisition of the two Seasonde base units prepped for deployment.

I. **Introduction**

This project addresses the challenge associated with management of natural resources in the Straits of Mackinac, the narrow channel connecting Lakes Michigan and Huron in the Great Lakes. While High Frequency radar has been employed extensively on the ocean coasts of the United States, it has been largely overlooked as a tool for freshwater observation and science. This is largely due to its limited propagation ranges over freshwater. However, a recent study of HF over freshwater shows significant potential in the use of HF to produce reliable current measurements within 25 km of shore, covering a broad expanse of many freshwater systems. Meadows et al (2013) provides a summary of High Frequency radar capabilities, outlining the value of such a system to observation networks in support of freshwater science. In the 2011 report commissioned by the Great Lakes Environmental Research Laboratory (LimnoTech et al., 2011), nine primary categories of user needs were identified as key to the development of the Great Lakes Observing System. Among these are several applications where High Frequency radar can play a role in critical data acquisition. These include improving the safety and efficiency of maritime operations through remote monitoring in critical channels and harbors, improvement of nearshore health and minimization of public health risks through monitoring of physical processes, and improved homeland security through measurements of critical parameters related to power sources and generation. Deployment of a system of HF radars in the Straits of Mackinac provides the equipment necessary to address all three of these areas of need. This project supports GLOS and its constituency region through the acquisition of a key data resource and integration of that resource's data throughout the network (Data Management and Integration), and timely, reliable and sustained observations of a key region of economic and environmental importance (Observations). This project also provides a unique resource to address all four key focus areas of the Blueprint for Great Lakes Decision Making by providing routine real-time access to current maps and hard target movements across the straits. Public and ecosystem health as well as water security and will benefit from the acquisition of times sensitive current maps to serve as a resource in the event of a spill or toxin transport event. Maritime operational concerns may benefit from the potential for the system to measure hard target returns including ships and ice. In the longer term, shifts in flow in the straits can be monitored with this system providing insights into climate change and other natural hazards such as harmful algal blooms. This proposed effort includes funding to complete the steps necessary to identify deployment sites (including identifying necessary permits and easements), develop site-specific requirements for the HF radar system to be deployed (including power and internet in addition to radar sensing requirements) in the Straits of Mackinac, and acquire the specified customized system for freshwater operational deployment. To assure ongoing operations of the system, Michigan Tech will seek follow on funding through GLOS, other federal and state agencies and other local resources, such

that the system will be installed and operated for as long as possible into the future. Should such funding not materialize, the equipment will be returned to GLOS for storage until such time as operational and maintenance funding can be acquired.

II. Project Description

As the first operational HF radar deployment in the Great Lakes, the development of this system will require a thorough evaluation of site-specific requirements including site location evaluations to meet freshwater HF requirements (e.g. close to water surface), system housing requirements (the Straits is a relatively remote site), and HF parameters (e.g. frequency). Through a pre-deployment field inspection and data collection exercise in Fall 2018, we will identify potential deployment sites, map transmit antennae patterns at various radar transmit conditions, and determine system requirements. This evaluation will be completed with collaboration from CODAR Ocean Sensors personnel. Upon completion of the field analysis, two SeaSonde Remote Unit base models tuned specifically for the selected sites will be acquired and prepared for deployment, following "right of way" approval for station siting and follow on funding for final setup costs.